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Tschacher

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[54] **PNEUMATICALLY OPERATED GRINDING APPARATUS**

[75] Inventor: **Hans-Dieter Tschacher,** Reichenbach, Fed. Rep. of Germany

[73] Assignee: **Festo-Maschinenfabrik Gottlieb Stoll,** Esslingen, Fed. Rep. of Germany

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[52] **U.S. Cl.** ..... **51/170 MT;** 51/273; 51/134.5 F

[58] **Field of Search** ..... 51/170 MT, 170 R, 273, 51/134.5 F, 170 PT, 170 T; 125/13 R

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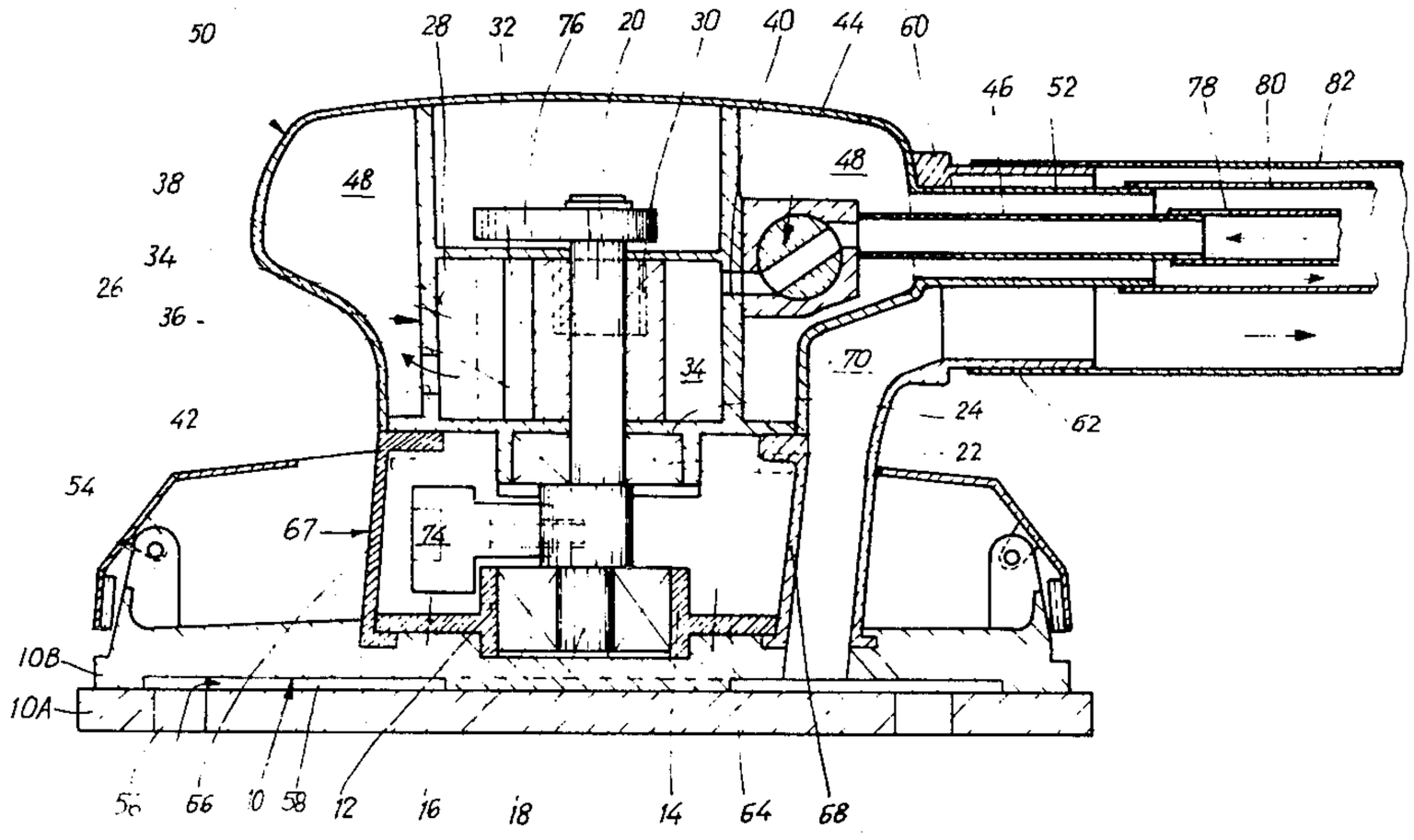
Primary Examiner—Roscoe V. Parker

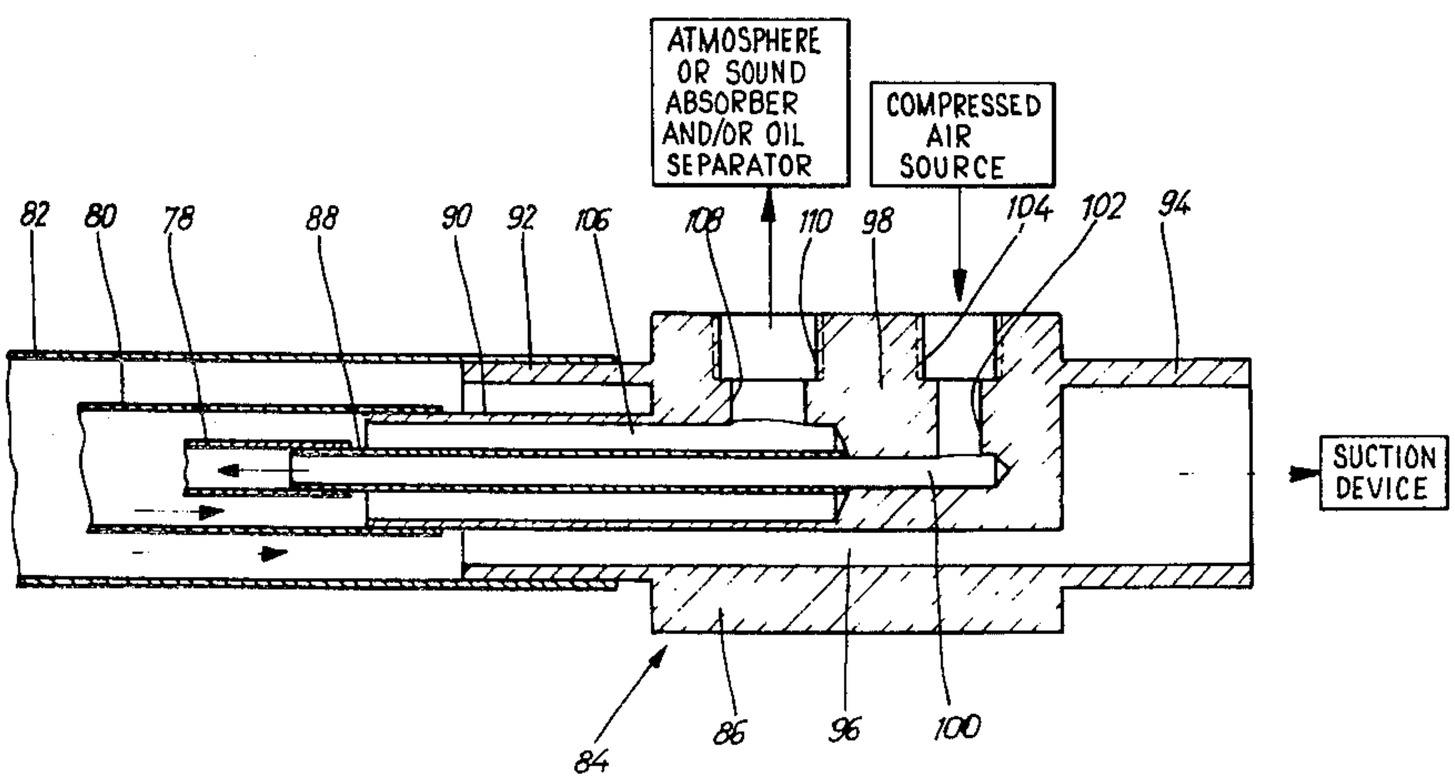
Attorney, Agent, or Firm—Blanchard, Flynn, Thiel et al.

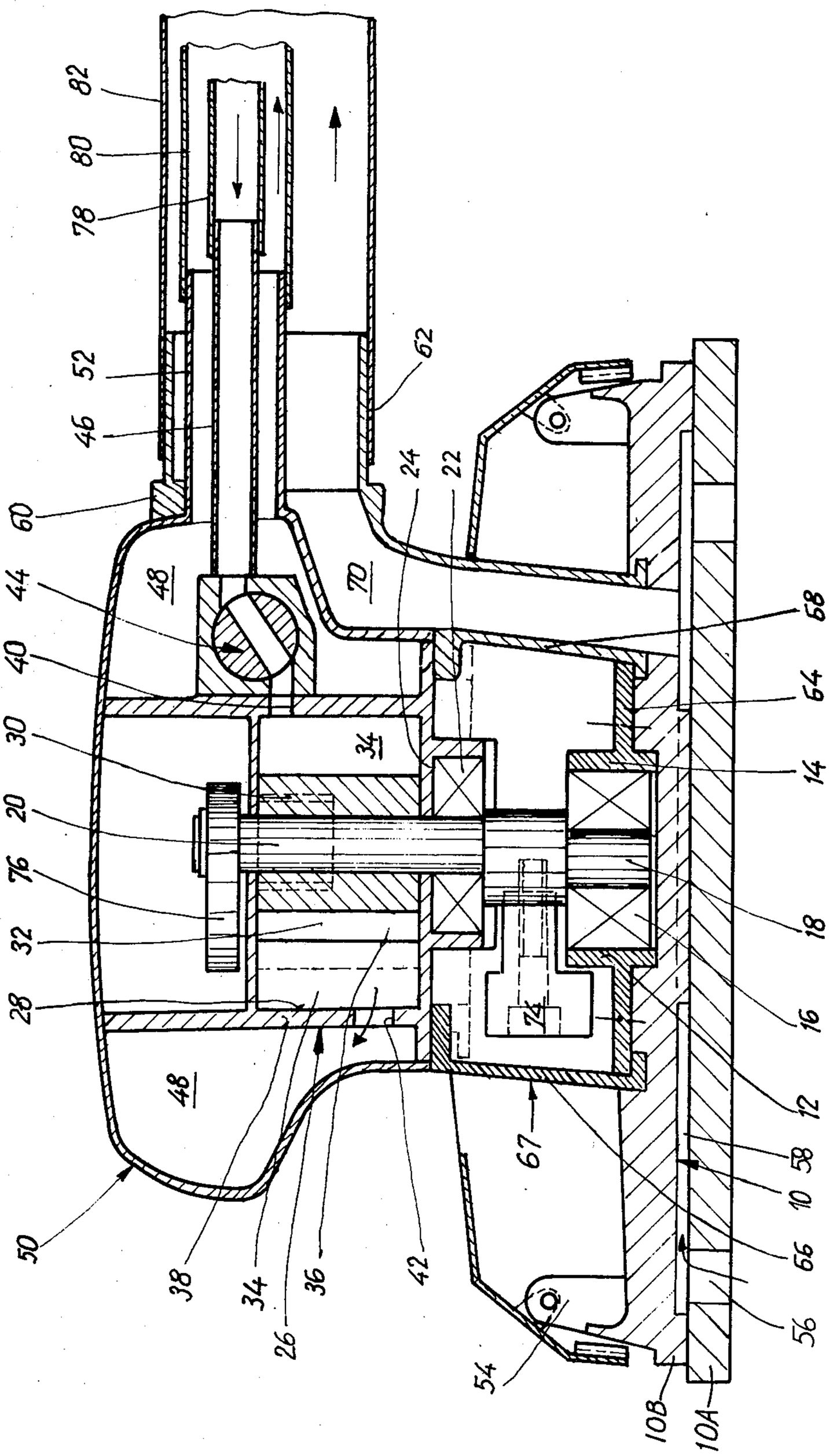
[57] **ABSTRACT**

A pneumatically operated grinding apparatus having a dust removal structure. The grinding apparatus has a housing and a movable work plate which is driven by a compressed-air motor. An inlet piping connection is provided for compressed air and is connected in fluid circuit with an inlet opening of the compressed-air motor. A suction piping connection is also provided which is connected to the inside of the housing and to which a suction device can be connected. A discharge-air piping connection is provided which is connected to an outlet of the compressed-air motor and is guided outwardly from the housing.

10 Claims, 2 Drawing Figures



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10B
10A

Fig. 1

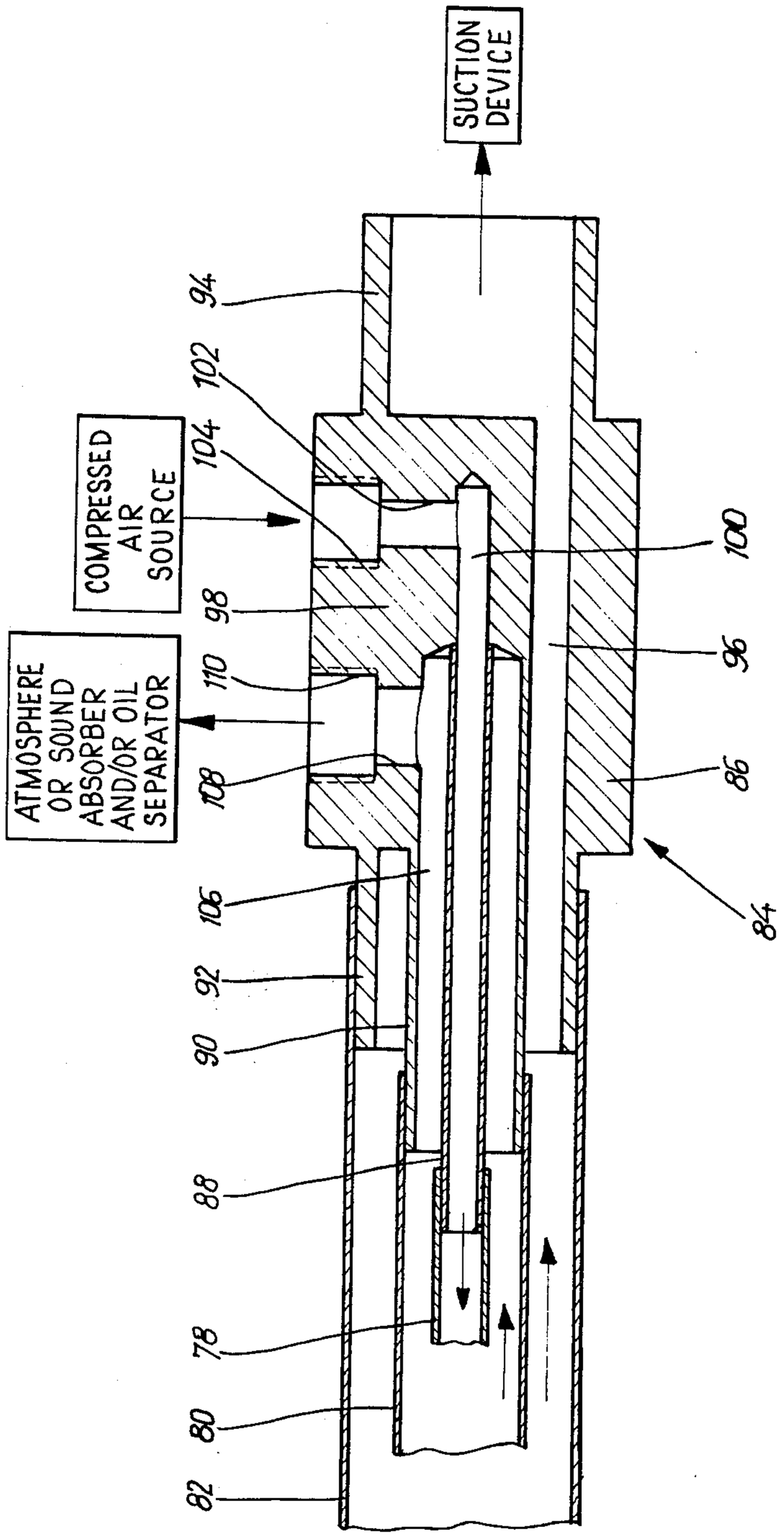
SUCTION DEVICE
COMPRESSED AIR SOURCE
ATMOSPHERE OR SOUND ABSORBER AND/OR OIL SEPARATOR
94
102
104
98
110
108
106
92
90
88
78
80
82
100
96
86
84

Fig. 2

PNEUMATICALLY OPERATED GRINDING APPARATUS

FIELD OF THE INVENTION

The invention relates to a pneumatically operated grinding apparatus.

BACKGROUND OF THE INVENTION

In such known grinding apparatus the outlet opening of the compressed-air motor communicates with the suction piping connection through a hose to the suction device for sucking off the grinding dust.

This has the disadvantage that the grinding apparatus must be designed for high performance, since it must not only absorb the amount of air which is needed for the suction of the grinding dust but also for the discharge air of the compressed-air motor. It is disadvantageous in this solution, since the oil which is contained in the discharge air cakes the grinding dust together to form to a connected mass in the suction device and is very poor in permitting air to pass therethrough.

The present invention is to provide a further development of a grinding apparatus so that it can be used together with a suction device having a low output.

In the inventive grinding apparatus, the discharge air is collected and discharged separately, and the suction device needs to be designed only for the air flow which is necessary for sucking off of the grinding dust. The grinding dust also does not come into contact with the oil traces and thus does not cake together in the filter of the suction device. Thus this filter also does not need to be cleaned as often; a cleaning of the filter which becomes necessary is simpler, since the filter cake can easily be removed from it.

With a further development of the invention, a compact arrangement of the hoses which carry the compressed air and discharge air is obtained. Furthermore one obtains in a very simple manner the requirement of providing differently sized cross-sectional dimensions for the hoses, as it must be chosen in view of the volume increase of the flow medium created during the exhaust of the compressed air in the compressed air motor.

With a still further development of the invention, it is achieved on the one side, that the entire hose arrangement can be handled externally as one unit. It is thereby particularly advantageous that the suction hose, which conducts the sucked-off air or the air-dust mixture, be designed mechanically strong because of the underpressure existing in it and thus also can hold together the hoses which lie particularly well in it. Furthermore in this manner one obtains also the desired large cross section for the suction piping connection and the suction hose, as it is desired in view of an unreduced forwarding of the suction output of the suction device to the grinding apparatus.

A still further development of the invention is preferable in view of the simple handling of the grinding apparatus. In the known grinding apparatus, several hoses for the air supply and air exhaust of the grinding apparatus started out from the apparatus itself, which hoses were able to get caught on the edges and corners of the workpiece. A "hose salad" is now avoided with the invention.

With a still further development of the invention, a splitting up of the common hose arrangement into individual hoses which extend in different directions is obtained in a very simple manner.

In a grinding apparatus embodying the invention, a minimum number of hoses exist also behind the adapter. The discharge air of the motor is exhausted through the deadener at the adapter to the atmosphere, which does not interfere since the adapter can be a considerable distance away from the actual working place.

Of course, it is possible to also choose a different form for the adapter, thus for example it may be round or cylindrical, if other situations permit this to be necessary.

The further development of the invention permits the use of the same hose material for the suction hose between the grinding apparatus and the adapter and between the adapter and the suction device.

The further development of the invention is advantageous in view of the secure placement of the adapter on a base and in view of the moving and removing of various hoses by rotation.

In a grinding apparatus embodying the invention, only two hoses need to exist for the air supply and the air exhaust for the grinding apparatus. The direct mounting of the deadener in the discharge-air piping connection is particularly not disadvantageous for grinding apparatus having a low work performance, since the discharge air exits from the deadener practically completely relaxed and diffused.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be discussed in greater detail hereinafter with reference to one exemplary embodiment and with reference to the enclosed drawings, in which:

FIG. **1** is a longitudinal cross-sectional view of a pneumatically operated grinding apparatus embodying the invention; and

FIG. **2** is an axial cross-sectional view of an adapter, through which a single hose which is connected to a suction device, an individual hose which is connected to a compressed-air source and a deadener which is connected to the outside atmosphere and is at the same time oil-separating, can be connected to a coaxial arrangement which extends to the grinding apparatus illustrated in FIG. **1**.

DETAILED DESCRIPTION

FIG. **1** illustrates a pneumatically operated grinding apparatus having a two-part work plate **10** composed of parts **10A** and **10B**, to which part **10A** an abrasive paper (not shown) can be clamped. The work plate **10** has on its upper side two upright walls **12**, **14** which serve as a guide for an outer race of an eccentric roller formed by a roller bearing **16**. The roller bearing **16** is mounted with its inner race fixedly engaging an eccentric end section **18** of a drive shaft **20**. The drive shaft **20** is supported through a further roller bearing **22** in the bottom wall **24** of a motor housing **26**. The latter is represented schematically in the drawing as a one-piece housing and consists as a rule of a plurality of closely connected housing segments. Further details concerning the design of the apparatus and the drive will be understood by skilled persons and, therefore, further discussion thereof is believed unnecessary.

The drive shaft **20** has secured thereto in a work chamber **28** of the motor housing **26** a hub member **30** having radially outwardly opening grooves **32**. The axis of the hub **30** is laterally offset with respect to the axis of the drive shaft **20**. Sealing blades **34** are arranged

radially movably in the grooves **32** so that they will be thrown radially outwardly by the centrifugal force, for example, during rotation of the shaft **20**. The drive shaft **20**, the hub member **30** and the sealing blades **34** form together the rotor of a rotation piston machine.

An inlet opening **40** for compressed air is constructed in a section of the peripheral wall **38** of the motor housing **26** and which defines the work chamber **28**, which section is located closest to the axis of the drive shaft **20**. An outlet slot **42** for the exhaust air is elongated in the peripheral direction starting at the section of the peripheral wall **38** farthest removed from the axis of the drive shaft **20** and terminating adjacent the inlet opening **40**, so that during the returning of a sealing blade to the inlet opening, a compression of air does not occur.

The inlet opening **40** is connected through a rotary slide valve **44** to an inlet piping connection **46**. The outlet slot **42** is connected to a discharge-air collecting chamber **48** defined on the inside thereof by the outside wall of the motor housing **26** and on the outside thereof by an apparatus housing **50**. The chamber **48** is connected to and communicates with a discharge-air piping connection **52** which is formed by the housing structure **50** and which coaxially surrounds the inlet piping connection **46**.

The work plate **10** has openings **56** therein which communicate with an annular chamber **58** formed between the two parts **10A** and **10B**. The chamber **58** is, in turn, connected to and communicates with a suction channel **70**, which can be constructed bellowslike.

A bottom flange **64** and edge walls **66**, **68** are appropriately formed and connected to the walls **12** and **14**, which together form a cup-shaped protective housing **67** surrounding the roller bearings **16** and **22** and the end section of the drive shaft **20**. In this manner, the grinding dust is prevented from penetrating into the roller bearing **16** and **22**.

The eccentric portion **18** of the drive shaft **20** is balanced at two points, for example by balancing weights **74,76** fastened to the drive shaft **20**.

A pressure hose **78** is moved onto and is connected to the inlet piping connection **46**. A discharge-air hose **80** is moved onto and connected to the discharge-air piping connection **52**. A suction-air hose **82** is moved onto and is connected to the suction piping connection **62**. The pressure hose **78** is a common flexible hose which is designed for the operating pressure of the grinding apparatus. The discharge-air hose **80** is a relatively thin flexible hose, which is completely sufficient (and is advantageous in view of the movability of the entire coaxial hose arrangement), since the discharge air in the hose **80** is under a higher pressure than the sucked-off air in the hose **82**, so that also the wall of the discharge-air hose **80** is subject to tension in the peripheral direction. The suction hose **82** must be sufficiently strong that it does not collapse under the underpressure which exists in it; on the other hand this hose too is not to influence too much the flexibility of the entire coaxial hose arrangement. Therefore, a bellowslike hose is used. All these hoses can be obtained as plastic hoses in the marketplace.

One recognizes that only one single hose appears from the outside to be connected to the grinding apparatus and must be moved together with the grinding apparatus. With this arrangement, the convenience in handling of the grinding apparatus is substantially improved and the danger of snagging the hose on edges and corners of the workpiece is substantially reduced.

FIG. **2** illustrates an adapter which as a whole is identified by the reference numeral **84** and through which a transition is created between the individual supply hoses for supplying and evacuating of the grinding apparatus and the coaxial hose arrangement.

The adapter **84**, which is a single or multipart plastic molded part, has in the illustrated exemplary embodiment a substantially square-shaped main body **86**. The shape of the main body may, however, also be different, for example it may be cylindrical or round. On the side adjacent the grinding apparatus, coaxially arranged tubes of increasing diameter are formed onto the main member **86**: a first connecting tube **88**, the outside diameter of which corresponds with the outside diameter of the inlet piping connection **46** and onto which the second end of the pressure hose **78** is fixedly fastened; a second connecting tube **90**, the outside diameter of which corresponds with the outside diameter of the discharge-air piping connection **52** and onto which the second end of the discharge-air hose **80** is fixedly fastened; and a third connecting tube **92**, the outside diameter of which corresponds with the outside diameter of the suction piping connection **62** and onto which the second end of the suction hose **82** is fixedly fastened.

The main body **86** of the coaxial connecting tube arrangement has on the opposite side remote from the grinding apparatus a coaxial connecting tube **94**. The outside diameter of the tube **94** equals the outside diameter of the suction piping connection **62** and the third connecting tube **92**—the aforementioned diameters, however, do not need to be absolutely the same—and which can be connected through a not illustrated, fixedly fastened hose of the same material as the suction hose **82** to a not shown suction device. The connection to the not illustrated suction device may, however, also occur directly, without a hose. The connecting tube **94** communicates with the third connecting tube **92** through a graduated ring chamber **96** radially offset from the central axis, the radially outer limit of which is a continuation of the inner wall of the third connecting tube **92** and the connecting tube **94** and the radially inner limit of which is defined by a partial cylindrical support block **98**, which carries the first connecting tube **88** and the second connecting tube **90**.

A first longitudinal channel **100** is constructed in the support block **98**, which channel is an extension of the inside of the first connecting piece and is connected through a radial channel section **102** to a connecting opening **104**, into which a connecting pipe (not illustrated) can be screwed for facilitating a supply or compressed air.

A second longitudinal channel **106** is provided in the support block **98** and is an extension of the inside of the second connecting tube **90** and is connected through a radial channel section **108** to a second connecting opening **110**, into which a sound absorber or an oil separator (not illustrated) can be secured therein, which is directly connected to the atmosphere. In place of it, it is also possible to screw in a connecting pipe to facilitate an air discharge through a discharge-air hose.

The aforementioned connections, however, can also be created in a different manner than by screwing, for example as snap or plug-in connection. The adapter **84** is during operation provided a greater distance away from the grinding apparatus, so that it remains stationary during the movement of the grinding apparatus. Also in the case of grinding apparatus having a high output, the exhaust air which is emitted from the sound

absorber or the oil separator is so far away from the actual working place that no grinding dust whatsoever is raised or blown around. The block-shaped design of the main body **86** facilitates a secure placement of the adapter on a plane base or a slight temporary clamping; one can so easily hold or clamp the adapter, when the various hoses are rotatingly telescoped under a press fit onto the various connecting tubes of the adapter or are removed therefrom.

It is possible in different, not illustrated embodiments to make the adapter connectible directly to connecting tubes on the suction device.

In a different variation, the arrangement can be such that the adapter is integrated in a suction system having an integrated supply port and an evacuation port, so as to facilitate a compact building foundation.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a pneumatically operated grinding apparatus having dust removal means, comprising an apparatus housing, in which a work plate which is driven by a compressed-air motor is movably supported, an inlet piping connection for compressed air connected in fluid circuit with an inlet opening of said compressed-air motor, a suction piping connection which is connected to the inside of the apparatus housing and to which a suction device can be connected, and a discharge-air piping connection which is connected to an outlet of said compressed-air motor, each of said inlet opening, said discharge-air piping and said suction piping means including passageway means to the exterior of said apparatus housing, the improvement comprising wherein said discharge-air piping connection surrounds said inlet piping connection, wherein said suction piping connection surrounds said inlet piping connection and said discharge piping connection, wherein separate flexible hoses are sealingly connected to said inlet piping connection, said discharge-air piping connection and said suction piping connection, wherein an adapter is provided, to which each of said flexible hoses, which come in the same direction from said inlet piping connection, said discharge-air piping connection and said suction piping connection, are sealingly connected, said adapter having separate axially arranged hose connecting tubes, one sealingly connected to said hose extending to said inlet piping connection, another sealingly connected to said hose extending to said discharge-air piping connection and still another sealingly connected to said hose extending to said suction piping connection, said adapter further having outlet openings aligned in different direction for connection to a compressed-air source, a discharge-air port and a suction device.

2. The grinding apparatus according to claim **1**, wherein at least said inlet piping connection and said discharge-air piping connection are arranged coaxially to one another on said grinding apparatus.

3. The grinding apparatus according to claim **1**, wherein a sound absorber is connected to one of said outlet openings in said adapter communicating with said discharge-air connection.

4. The grinding apparatus according to claim **1**, wherein an oil separator is connected to one of said outlet openings in said adapter communicating with said discharge-air connection.

5. The grinding apparatus according to one of the claims **3** or **4**, wherein said outlet opening communicating with said suction piping connection on said adapter is connected directly to said suction device.

6. The grinding apparatus according to claim **1**, wherein an outlet opening of said adapter is constructed as a connecting tube which is constructed coaxially with respect to said hose connecting tubes for the exhaust dust-containing air.

7. The grinding apparatus according to claim **6**, wherein the axis of the outlet opening for said compressed-air source and the axis of said outlet opening for said discharge-air port define an angle with the common axis of said hose connecting tubes.

8. The grinding apparatus according to claim **6** or **7**, wherein said hose connecting tube which carries the flexible suction hose and said outlet opening for said suction device have the same outside diameter.

9. The grinding apparatus according to claim **1**, wherein said adapter is a plastic part which is molded in one piece.

10. The grinding apparatus according to claim **1**, wherein said hose connecting tubes on said adapter are coaxial.

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